The Phoenix Scout Mission

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ATLO → 1 Day
Ship → 400 Days
Launch → 479 Days
EDL → 775 Days

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Lessons Learned--Step 1

- Choose your science goals carefully, they will not be re-competed in Step 2 yet the mission implementation depends on them
  - Phoenix chose to explore the polar environment drawing on the recent discovery of subsurface ice in the polar region to focus the science goals
  - This allowed us to meet many of the MEPAG goals: the characterization and history of the water in all its phases, the polar climate, and the potential that the ice provides a habitat for microbes
  - It has been easy to define these goals in a way that exceeds our budget

Institutional Cultures

- NASA centers and aerospace companies approach missions and cost them in completely different ways
  - Be sure that your project manager understands the subtleties of cost estimating
  - Is the schedule reserve funded, or not? Yes, for universities and NASA centers, often no for aerospace
  - How optimistic is the workforce? Compare with recently completed missions at the subsystem level
  - Realistic costs up front allow for a true reserve pot

Heritage Instruments

- Were designed for different science goals and environments
  - The robotic arm inherited from the 2001 mission to the equator could not dig into hard icy soils at cold temperatures and had to be completely redesigned
  - Faster, better, cheaper hardware requires expensive reliability engineering to make it acceptable to new missions
  - The original engineering team is the best heritage, are they still available?

Cost Estimates

- Heritage hardware is always underestimated because of the reasonable assumption that the cost is well known
  - Changing requirements and poor assumptions about hardware quality drive costs higher
- The reserves are likely to be fully committed by the end of phase B without very conservative cost postures in phase A

Recommendations

- After step 1, be sure that the science requirements are as loose as possible and yet meet the science objectives
- Be sure that the mission assurance requirements for the mission are commensurate with the hardware
- Do a complete review of the margins in schedule, mass, power, cost, and data
- Be very conservative on all cost margins
- Compare with similar mission costs and margins